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ABSTRACT

The use of a strategy for determining the comparable common factors in a set of data are illustrated in this report. Both orthogonal and oblique derived sclutions were obtained for each of several different initial factor methods. The results were compared across the various solutions and three types of factors were determined: ccmparable common factors, comparable specific factors, and ncn-ccmparable factors. Factor results used for this illustration are the reanalyses of the data of nine of the Guilford studies as previously reported by one of these authors. The number of comparable common factors for the data in any one of the matrices is always considerable fewer than the number of common factors obtained by Guilford. A few of the CCF's agree rather closely with common factors obtained by Guilfcrd. In many instances two or more of Guilford's common factors coalesce into one comparable common factor. (Author/FL)

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A FACTOR ANALYTIC INTERPRETATION STRATEGY

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Technical Report No. 115

A FACTOR ANALYTIC INTERPRETATION STRATEGY

By Margaret L. Harris
and Chester W. Harris

Report from the Technical Section
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and the
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Wisconsin Research and Development
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STATEMENT OF FOCUS

This Technical Report is from the Technical Development Program, whose principal function is to identify and invent research and development strategies taking into account current knowledge in the fields of statistics, psychometrics, and computer technology. The Technical Development Program collaborates in applying such strategies in research and development. The translation of theory into practice and presentations of exemplars of methodology are challenges which the Technical Development Program strives to meet.

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ABSTRACT

This paper illustrates the use of a strategy for determining the comparable common factors in a set of data. Both orthogonal and oblique derived solutions were obtained for each of several different initial factor methods. The results were compared across the various solutions and three types of factors were determined—comparable common factors, comparable specific factors, and non-comparable factors.

The factor results used for this illustration are the reanalyses, by seven different methods, of the data of nine of the Guilford studies as reported by Chester W. Harris (1967).

The number of comparable common factors for the data in any one of the matrices is always considerably fewer than the number of common factors obtained by Guilford. In general, a few of the CCFs agree rather closely with common factors obtained by Guilford. In many instances two or more of his common factors coalesce into one comparable common factor.

INTRODUCTION

The purpose of this paper is to illustrate the use of a strategy suggested by Chester W. Harris (1967) for determining the common factors in a set of data. He suggested using several different computing algorithms for the initial solution, obtaining derived solutions, both orthogonal and oblique, comparing the results, and regarding as the important substantive findings those factors that are robust with respect to method. This paper illustrates a way of comparing the results.

The factor results used for this illustration of a factor analytic interpretation strategy are the reanalyses, by seven different solutions, of the data from nine of the Guilford studies as reported by C. Harris (1967). The initial component and factor methods used are Incomplete Principal Component (Hotelling, 1933), Alpha (Kaiser & Caffrey, 1965), a Jöreskog method (1963, 1967), and Harris R-S^2 (1962). The Jöreskog method used for Matrices 08 and 23 is his new Unrestricted Maximum Likelihood Factor Analysis (UMLFA) procedure (1967) using a critical value of .05; Jöreskog's early procedure (1963) was used for the other seven matrices. These four methods provide a component solution (Incomplete Principal Component), a factor solution with a statistical basis (Jöreskog, 1963 or UMLFA), and two factor solutions with a psychometric basis: one for a minimum number of factors (Alpha) and one for a maximum number of factors (Harris R-S^2). Derived orthogonal solutions were obtained for each of the four initial solutions using the Kaiser normal varimax* procedure (1958) and derived oblique solutions were obtained for the first three initial solutions using the Harris-Kaiser independent cluster solution (1964). An oblique solution was not obtained for the Harris R-S^2 method since it would have certain correspondences to the oblique solution obtained from the Jöreskog (1963) method.

The number of initial factors (components) obtained for each of the four methods is given in Table 1. Also included in this table is the number of common factors (components) obtained for each of the seven derived solutions. A common factor (component) is defined as one having at least two variables with coefficients greater than .30 (absolute). All of the common factors are utilized for the interpretation strategy illustrated in this paper; thus, all of the variables with values greater than .30 (absolute) on one or more common factors appear in the tables. Note that Guilford used a coefficient of .30 (absolute) as a critical value in interpreting his derived orthogonal factors.

*Guilford and Hoepfner (1969) have compared varimax rotations with rotations to theoretical targets and essentially rejected the former as not giving meaningful results. It seems likely that they would find our results, given in Tables 3 through 11, unsatisfactory since these do not reproduce the Structure of Intellect model in detail but instead suggest alternative interpretations.

PROCEDURE

The procedure involves attempting to find the common factors (components) that are similar over solutions. This was done by starting with a derived orthogonal component from the Incomplete Principal Component initial method. The reason is that this solution tends to include more variables with coefficients greater than .30 on a particular component than any of the other solutions. Then for each other derived orthogonal solution and for each derived oblique solution, a common factor was searched for that seemed to be similar to the component selected, particularly with respect to the large coefficients.

The next step involved determining those factors (components) that are robust with respect to method—factors which tend to include the same variables across methods. A variable

Table 1
Numbers of Initial and Derived Common Factors for the Various Methods

Matrix	Factor Method	Initial Factors	Orthogonal Common Factors	Oblique Common Factors
08	Incomplete Principal Component	14	13	14
	Alpha	14	11	13
	UMLFA	19	10	14
	Harris R-S^2	28	10	
09	Incomplete Principal Component	15	12	14
	Alpha	15	13	13
	Jöreskog	*		
	Harris R-S^2	39	11	
12	Incomplete Principal Component	13	12	13
	Alpha	13	10	12
	Jöreskog	7	7	7
	Harris R-S^2	30	7	
14	Incomplete Principal Component	6	6	6
	Alpha	6	6	6
	Jöreskog	4	4	4
	Harris R-S^2	13	7	
16A	Incomplete Principal Component	6	5	6
	Alpha	6	5	5
	Jöreskog	4	4	4
	Harris R-S^2	16	7	
16B	Incomplete Principal Component	6	6	5
	Alpha	6	6	5
	Jöreskog	4	4	4
	Harris R-S^2	14	7	
16C	Incomplete Principal Component	6	6	6
	Alpha	6	6	6
	Jöreskog	6	5	6
	Harris R-S^2	14	6	
22	Incomplete Principal Component	12	11	11
	Alpha	**		
	Jöreskog	7	7	7
	Harris R-S^2	24	8	
23	Incomplete Principal Component	5	5	5
	Alpha	5	5	5
	UMLFA	5	5	5
	Harris R-S^2	17	6	

* Went to p-1 factors.
** Did not converge.

was considered relevant to a factor if it had a coefficient greater than .30 (absolute) on that factor. A comparable common factor (CCF) was defined as one having two or more of the same relevant variables on at least five of the seven derived factors (components). This means that a comparable common factor is defined by more than two different initial solutions and by both orthogonal and oblique rotations. Thus, no one initial method can account for a variable's rejection and no one derived method can account for a variable's acceptance on a comparable common factor. Note that for the two matrices for which one of the initial solutions was not

available, Matrix 09 and Matrix 22, a comparable common factor is defined as one having two or more of the same relevant variables on at least four of the five solutions.

Two other types of factors may be found. A comparable specific factor (CSF) is defined as one having only one (the same) relevant variable on at least five of the solutions. A noncomparable factor (NCF) is defined as one not having any one or more of the same relevant variables on at least five of the solutions.

Table 2 contains the number of comparable common factors, comparable specific factors, and noncomparable factors for each of the nine matrices. The number of common factors obtained by Guilford for each matrix is also given in Table 2.

RESULTS

The results for the nine matrices are given in Tables 3 through 11, pages 3 to 34. The matrices included, though not in this order, are:

- 08 Creative thinking
- 09 Evaluative abilities
- 12 Planning
- 14 General reasoning
- 16 Reasoning, creativity, and evaluation (Subdivided into three —16A, 16B, and 16C)
- 22 Problem-solving abilities
- 23 Cognition and convergent production.

The relevant variables are in capital letters and the non-relevant variables (noise?) are in small letters. The order of the factors in the tables is arbitrary within each of the three types of factors (CCFs, CSFs, and NCFs). Guilford's results are presented in each table with the factors of the reanalyses with which they seem to agree most closely.

The two matrices chosen as first illustrations of the strategy are 23 and 08. Matrix 23 was chosen to illustrate the fairly close agreement across methods that can be secured among the various factor solutions. Matrix 08 was chosen as the matrix for which the various factor solutions were in least agreement. Of the nine matrices studied, the results for 08 and 09 seemed to be the most discrepant across the seven derived solutions. Of these two, Matrix 08 was chosen for presentation here because one initial factor method was not available for Matrix 09. For 08 the various solutions agree in part but for some of the factors the results are quite diverse. Table 3 contains the results for Matrix 23 and Table 4 the results for Matrix 08. Note that the variables relevant to the comparable common factors are in capital letters.

For Matrix 23 the factors are rather robust over solutions. There are five comparable common factors for the 30 variables in this matrix and one noncomparable factor. This is in contrast to the 13 common factors obtained by Guilford.

As shown in Table 4, the results for Matrix 08 are not as robust over solutions as they were for Matrix 23; the results from the various

Table 2
Number of Factors for Each Matrix

Matrix	Reanalyses			Guilford
	Comparable Common Factors	Comparable Specific Factors	Noncomparable Factors	Common Factors
08	10	0	8	15
09	10	1	10	14
12	7	2	4	14
14	6	0	1	9
16A	4	1	5	11
16B	5	0	3	9
16C	5	0	5	10
22	7	0	7	13
23	5	0	1	13

Table 3
Factor Results for Matrix 23*

	Reanalyses							Guilford					
	Orthogonal				Oblique								
	I	II	III	IV	I	II	III	E					
COMPARABLE COMMON FACTOR 1													
9 LIMITED SUMS	56	43	45	44	48	42	55	37					
12 NUMBER RELATIONS	46	38	48	39	32	36	57						
14 NUMERICAL OPERATIONS	59	39	45	58	54	39	59	51					
16 OPERATIONS SEQUENCE	50	45	53	43	37	42	61						
19 PICTURE-GROUP NAMING	-66	-51	-41		-78	-61	-67						
COMPARABLE COMMON FACTOR 2								A					
2 CAMOUFLAGED WORDS	52	41	39	38	47	40	47						
12 NUMBER RELATIONS	37	37	37		34	43	40						
17 ORDERING I	77	62	52	58	87	79	74	36					
23 VERBAL COMPREHENSION	64	49	57	48	62	50	81	51					
30 WORD TRANSFORMATIONS	44	39	43	46	33	33	49						
1 Alterations			32										
20 Seeing Trends II	38	34	42				43	32					
22 Symbol Grouping					-35		-32						
26 Word Fluency					-31								
27 Word Groups	43	38	46				49	41					
COMPARABLE COMMON FACTOR 3								B	D	G	H	L	M
3 CIRCLE REASONING	54	45	46	48	65	52	55				40		
7 LETTER GROUPING	53	55	54	51	49	48	46				40		
8 LETTER TRIANGLE	69	65	62	68	86	80	72				42		
13 NUMBER SERIES CORRECTION	40	40	36	38	37	34		44			31		
16 OPERATIONS SEQUENCE	55	58	56	56	53	48							52
18 PICTURE ARRANGEMENT	56	46	45	42	74	62	61		55				
20 SEEING TRENDS II	54	49	48	44	60	54	50			51			
22 SYMBOL GROUPING	61	53	52	45	75	66	64					35	30
24 WORD CHANGES	64	65	63	64	69	67	56			35		36	49
27 WORD GROUPS	47	43	43	42	48	41	35						
28 WORD PATTERNS	43	40	39	31	42	38	39					50	
29 WORD RELATIONS	57	56	56	55	59	54	52			33			

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III UMLFA
IV Harris R-S^2

Key to Guilford Factors:

E Numerical Facility
A Verbal Comprehension
B General Reasoning
D Ordering
G Eduction of Symbolic Relations
H Eduction of Patterns
L Cognition of Symbolic Implications
M Convergent Production of Symbolic Systems

Table 3 (Continued)

	Reanalyses							Guilford					
	Orthogonal				Oblique								
	I	II	III	IV	I	II	III	B	D	G	H	L	M
COMPARABLE COMMON FACTOR 3 (Continued)													
1 Alterations	36	36	36	36									
6 Letter Analogies	32	35	33								31		
9 Limited Sums	32	36	31	34				37					
10 Number Classification												49	
12 Number Relations	35	37	33	38				45					
17 Ordering I									36				
21 Ship Destination			56				64	50					
COMPARABLE COMMON FACTOR 4								C	K				
5 FOUR-LETTER WORDS	45	36	33		44	33	31						
7 LETTER GROUPING	40	38	36	33			33		37				
10 NUMBER CLASSIFICATION	71	56	57	63	75	61	66		41				
11 NUMBER-GROUP NAMING	83	77	79	66	93	91	94	45	60				
12 NUMBER RELATIONS	40	42	35	37	31				44				
13 NUMBER SERIES CORRECTION	40	34	33	35	35				32				
6 Letter Analogies	32												
19 Picture-Group Naming	37				36		38	50					
27 Word Groups								32					
COMPARABLE COMMON FACTOR 5								F	I	J			
1 ALTERATIONS	48	48	43	47	41	40		31		32			
2 CAMOUFLAGED WORDS	43	42	39	44	40	35			44				
4 DISEMVOWELLED WORDS	78	76	77	73	91	96	85	41		53			
5 FOUR-LETTER WORDS	43	38	41	40	44	36	36		36	43			
15 OMELET TEST	73	70	72	71	82	82	75	47		49			
25 WORD COMBINATIONS	65	60	60	63	69	64	56	31		52			
26 WORD FLUENCY	70	55	52	54	89	74	61	50					
28 WORD PATTERNS	44	37	39	34	41	34	35						
30 WORD TRANSFORMATIONS	55	55	50	54	53	49	33		53				
6 Letter Analogies			31										
7 Letter Grouping	38	39	38	37									
12 Number Relations				32									
18 Picture Arrangement					-35								
27 Word Groups		32											
29 Word Relations	41	42	36	37									
NONCOMPARABLE FACTOR 6													
20 Seeing Trends II				36									
27 Word Groups				42									

Key to Guilford Factors:

C Naming Abstractions
K Cognition of Symbolic Classes
F Word Fluency
I Symbolic Redefinition
J Cognition of Symbolic Units

Table 4
Factor Results for Matrix 08*

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	D	
COMPARABLE COMMON FACTOR 1									
35 PUNCHED HOLES	57	49	50	52	48	37	34	45	
48 PRACTICAL JUDGMENT	60	47	38	46	68	56	37	32	
51 MECHANICAL PRINCIPLES	80	71	78	69	86	78	80	54	
52 ARITHMETIC REASONING	45	44	51	49	36	33		38	
16 Match Problems	41	38		34					
34 Word Matrices	31								
COMPARABLE COMMON FACTOR 2								C	F
36 MUTILATED WORDS	40	36	38		33		50		35
37 STREET GESTALT COMPLETION	70	62	63	59	71	70	64	37	44
38 PERCEPTUAL SPEED	64	58	54	57	65	47		56	
41 UNUSUAL DETAILS	34	33	33	31			34		
42 PENETRATION OF CAMOUFLAGE	76	67	68	67	81	72	55	45	40
47 SPATIAL ORIENTATION (PART I)	60	54	50	53	59	44		47	
35 Punched Holes		32							
COMPARABLE COMMON FACTOR 3								B	
49 NUMERICAL OPERATIONS (PART I)	83	76	76	74	93	90	80	72	
50 NUMERICAL OPERATIONS (PART II)	78	70	77	73	83	79	82	73	
52 ARITHMETIC REASONING	50	45	43	43	43	38		49	
1 Sentence Analysis					-31				
44 Ship Destination	33								
47 Spatial Orientation (Part I)	37				35			37	

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III UMLFA
IV Harris $R\text{-}S^2$

Key to Guilford Factors:

D Visualization
C Perceptual Speed
F Closure
B Numerical Facility

Table 4 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	A	E
COMPARABLE COMMON FACTOR 4									
1 SENTENCE ANALYSIS	39	32	33		43	37	51		
2 PARAGRAPH ANALYSIS	49	35	35		60	47	41		
27 SENTENCE GESTALT (OMISSIONS)	-60	-54		-47	-76	-75		53	
33 SENTENCE SYNTHESIS	65	64	65	62	64	63	67	53	
43 VOCABULARY	71	68	70	70	74	74	61	65	
46 INFERENCE TEST	67	63	64	58	68	64	73.	47	
53 SENTENCE GESTALT	42	46	48	47	32			43	
11 Number Associations (Uncommonness)		31						31	
14 Circle Square I			34				32		
15 Circle Square II	40	43	46	37				36	
17 Sign Changes	34	35	38				38		
18 Implied Uses	32	37	42	39					
21 Associations II			31						
28 Word Transformation			32						
32 Concept Synthesis	32	37	39	40				35	
34 Word Matrices		35	40	32					38
44 Ship Destination	36	35	38				32		42
51 Mechanical Principles									33
52 Arithmetic Reasoning	34	39	42	32					35
COMPARABLE COMMON FACTOR 5								N	
24 APPARATUS TEST	69	59	60	61	70	67	60	59	
25 SOCIAL INSTITUTIONS (DIRECT)	80	67	75	66	90	84	83	70	
13 Consequences (Remote)	37				31				
22 Unusual Uses	32								
41 Unusual Details	31								
44 Ship Destination	31				34				
COMPARABLE COMMON FACTOR 6								G	H
28 WORD TRANSFORMATION	72	59	52	58	75	70	57	52	32
40 DISARRANGED WORDS	72	54	57	53	79	62	32	38	
53 SENTENCE GESTALT	55	49	48	43	44	45	92	56	
11 Number Associations (Uncommonness)									33
14 Circle Square I								36	
15 Circle Square II	38	31						44	
27 Sentence Gestalt (Omissions)									34
36 Mutilated Words	31							37	
39 Controlled Associations	31		32						46

Key to Guilford Factors:

A Verbal Comprehension
E General Reasoning
N Sensitivity to Problems
H Associational Fluency
G Word Fluency

Table 4 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	K
COMPARABLE COMMON FACTOR 7								
16 MATCH PROBLEMS	44	32	32		47	43	45	37
45 SYMBOL MANIPULATION	62	40	44		65	49	36	
17 Sign Changes								32
23 F-Test					-36			
35 Punched Holes							33	
38 Perceptual Speed	35		32		35	45		
49 Disarranged Words							35	
43 Vocabulary					-31	-37	-43	
53 Sentence Gestalt						-31		
COMPARABLE COMMON FACTOR 8								M
29 GESTALT TRANSFORMATION	61	50	48	38	56	39	53	37
30 PICTURE GESTALT	67	48	45	52	79	69	46	
19 Quick Responses (Uncommonness)							-37	
23 F-Test					-36			
31 Object Synthesis								31
41 Unusual Details					35	32		
48 Practical Judgment								31
COMPARABLE COMMON FACTOR 9								I
5 IMPOSSIBILITIES	50	35		44	45	39		39
6 PLOT TITLES (LOW QUALITY)	70	58		57	82	77		59
8 COMMON SITUATIONS	75	50		50	69	68		55
9 BRICK USES (FLUENCY)	74	48		49	72	66		54
12 CONSEQUENCES TEST (LOW QUALITY)	71	64		65	86	80		55
1 Sentence Analysis	38				32			
3 Figure Analysis	43				35			—
4 Figure Concepts (Uncommonness)	33							
13 Consequences Test (Remoteness)	36							
22 Unusual Uses	44							
24 Apparatus Test	35							
31 Object Synthesis	34							
39 Controlled Associations	52							
41 Unusual Details	32							

Key to the Guilford Factors:

K Adaptive Flexibility
M Redefinition
I Ideational Fluency

Table 4 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	J	L
COMPARABLE COMMON FACTOR 10									
10 BRICK USES (FLEXIBILITY)	55	52	50	53	61	58	56		43
18 IMPLIED USES	52	38	34	33	65	60			
22 UNUSUAL USES	39	67	69	63	37	50	64	31	39
39 CONTROLLED ASSOCIATIONS	41	50	47		40	46			
1 Sentence Analysis	31	35	39	35					
3 Figure Analysis		47	47	44			43		
4 Figure Concepts (Uncommonness)		53	51	55			49	32	
5 Impossibilities		46	53	41			41	31	
6 Plot Titles (Low Quality)			34						
7 Plot Titles (Cleverness)		44	50	42			45	55	
8 Common Situations		57	68	54			67	31	33
9 Brick Uses (Fluency)		52	63	49			67		
11 Number Associations (Uncommonness)		51	43	44			31		
13 Consequences Test (Remoteness)		62	65	65			63	42	33
19 Quick Responses (Uncommonness)		33	32	34				49	
20 Associations I		45	43	38					
23 F-Test			35						
24 Apparatus Test		33	40						
25 Social Institutions (Direct)			35						
31 Object Synthesis		32	39				39		
32 Concept Synthesis	34				45	31			
34 Word Matrices	44				64	53			
37 Street Gestalt Completion					42				
38 Perceptual Speed						-34			
41 Unusual Details			35						
NONCOMPARABLE FACTOR 11								**O**	
14 Circle Square I					-31				
24 Apparatus Test		34	34				34	34	
26 Social Institutions (Indirect)		63	71		84		74	45	
NONCOMPARABLE FACTOR 12									
38 Perceptual Speed							63		
47 Spatial Orientation (Part I)							53		
NONCOMPARABLE FACTOR 13									
40 Disarranged Words							-35		
52 Arithmetic Reasoning							67		

Key to Guilford Factors:

J Originality L Spontaneous Flexibility O "Doublet"

Table 4 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	
NONCOMPARABLE FACTOR 14								
4 Figure Concepts (Uncommonness)	31							
6 Plot Titles (Low Quality)					-39	-33	-102	
7 Plot Titles (Cleverness)	70				84	71	34	
13 Consequences Test (Remoteness)	39				34			
19 Quick Responses (Uncommonness)	65				63	31		
48 Practical Judgment					36			
NONCOMPARABLE FACTOR 15								
14 Circle Square I				41				
15 Circle Square II				42				
NONCOMPARABLE FACTOR 16								
17 Sign Changes	47				50	34		
23 F-Test	-34							
29 Gestalt Transformation					33			
31 Object Synthesis	-56				-62	-46		
32 Concept Synthesis	35							
36 Mutilated Words	39				39			
NONCOMPARABLE FACTOR 17								
4 Figure Concepts (Uncommonness)	31				34			
11 Number Associations (Uncommonness)	42				46	34		
12 Consequences Test (Low Quality)					-35			
19 Quick Responses (Uncommonness)					42	47		
20 Associations I	64				75	55		
23 F-Test					33	31		
29 Gestalt Transformation					-32	-37		
NONCOMPARABLE FACTOR 18								
11 Number Associations (Uncommonness)								35
18 Implied Uses								36
39 Controlled Associations								73

solutions are comparable (in the sense defined for this strategy) for some factors but not for others. It should be pointed out here that for both 10 and 12 factors the UMLFA method yielded an improper solution since the unique variance for variable Number 27, Sentence Gestalt (Omissions), was equal to or less than .02. Jöreskog suggests partialling out any

variables that have a unique variance that is essentially zero (<.02). It was decided, instead, to remove this variable from the intercorrelation matrix. The solution given here for UMLFA is for 15 factors for 52 variables, with variable number 27 omitted. There are ten comparable common factors for the 53 variables in Matrix 08 and eight noncomparable factors. Guilford obtained 15 common factors for this set of data.

The results of the application of our factor analytic interpretation strategy to the remaining seven matrices are given in Tables 5 through 11. As mentioned earlier the seven derived solutions seemed to be very similar for Matrix 23. They are most discrepant for Matrices 08 and 09. The results seem to be fairly similar for Matrices 14 and 16B. For Matrices 12, 16A, 16C, and 22 there is some close agreement and some diversity. The comparable common factors of Matrices 09 and 22 seem to have relatively few relevant variables.

In general, the number of comparable common factors is similar to the smallest number of common factors in the derived solutions of the reanalyses. For one matrix (09) the number of CCFs is one less than the smallest number of common factors obtained for any one derived solution. For six of the matrices (08, 12, 16A, 16C, 22, and 23) the number of CCFs is equal to the smallest number of common factors obtained for any one or more derived solutions. The number of CCFs is greater than the smallest number of common factors for a single derived solution for two of the matrices (14 and 16B).

The number of comparable common factors for the data in any one of the matrices is always considerably fewer than the number of common factors obtained by Guilford. In general, a few of the CCFs agree rather closely with common factors obtained by Guilford. In many instances two or more of his common factors coalesce into one comparable common factor.

Table 5
Factor Results for Matrix 09*

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	L
COMPARABLE COMMON FACTOR 1								
4 LOGICAL REASONING	35	32	**		35	33	**	
25 SOCIAL SITUATIONS	65	46			75	54		
32 WORD CHECKING I	63	63		74	50	52		46
33 WORD CHECKING II	74	73		80	70	73		62
36 RATIO ESTIMATION TEST	59	55		31	65	65		32
42 Ship Destination	36	32						

*Decimals have been omitted.

**Method III went to p-1 factors, one less than the number of variables, and is not included here.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factors:

L Speed of Evaluation

Table 5 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	I	
COMPARABLE COMMON FACTOR 2									
9 CRITICAL EVALUATION	46	42			34	32		38	
12 VERBAL CLASSIFICATION	51	53			42	46		48	
22 GESTALT TRANSFORMATION	72	53			89	76			
29 PICTURE CLASSIFICATION	59	50			58	55			
7 Sentence Evaluation	35	33						31	
10 Titles					-33				
13 Word Classification	33	33							
15 Generalizations	44	40			32				
COMPARABLE COMMON FACTOR 3								C	D
36 RATIO ESTIMATION TEST	42	42		35		31		32	
40 PUNCHED HOLES	75	63			71	58		58	
41 MECHANICAL PRINCIPLES	61	51			53	36		59	
43 ARITHMETIC REASONING	58	62		65	49	33		32	50
4 Logical Reasoning				44					
11 Logical Classification					-32	-53			
14 Interpretations									30
16 Word Selection					-44	-55			
18 Reading Comprehension	40	43		46				34	31
23 Practical Judgment									42
37 Vocabulary						-35			
42 Ship Destination		32							43
45 Figure Analogies Completion	32	31						42	
COMPARABLE COMMON FACTOR 4								K	
34 FIGURE ESTIMATION (PART I)	82	59			90	71		34	
36 RATIO ESTIMATION TEST	33	34		31	32	40		50	
6 Inferences II	33								
15 Generalizations	34			65	33				
26 Sound Grouping								33	
COMPARABLE COMMON FACTOR 5								B	
38 SPATIAL ORIENTATION (PART I)	46	40			37	32		35	
39 SPATIAL ORIENTATION (PART II)	78	64			81	66		45	
6 Inferences II					-40	-32			
25 Social Situations					-33				
36 Ratio Estimation Test								37	
45 Figure Analysis Completion	41	36				33			

Key to Guilford Factors:

I Verbal Classification
C Visualization
D General Reasoning
K Perceptual Evaluation
B Perceptual Speed

Table 5 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	N	
COMPARABLE COMMON FACTOR 6									
27 FIGURE CLASSIFICATION	54	44			47	47		43	
30 FIGURE MATCHING	78	65			91	83			
45 FIGURE ANALOGIES COMPLETION	45	41			47	51			
11 Logical Classification	31							30	
14 Interpretations								39	
19 Absurdities					-31				
COMPARABLE COMMON FACTOR 7								H	E
1 SYLLOGISMS I	80	79		51	100	111		62	36
2 SYLLOGISMS II	73	63		80	78	76		61	
3 SYLLOGISMS III	74	70		48	86	85		62	31
4 LOGICAL REASONING	50	45		33	48	45		55	
5 INFERENCE TEST	55	48			48	40		49	
19 ABSURDITIES	48	38			42	35			
26 SOUND GROUPING	43	39			32	31			32
44 CORRELATE COMPLETION	44	37			46	37			31
45 FIGURE ANALOGIES COMPLETION	38	34			39	37			50
7 Sentence Evaluation	37	32							
8 Facts and Opinions								30	
11 Logical Classification								42	
12 Verbal Classification	42	36				31			
16 Word Selection	36	34			31			47	
17 Evaluation of Comparisons	36	32						36	
18 Reading Comprehension	37	34						31	
37 Vocabulary								31	
COMPARABLE COMMON FACTOR 8								F	M
31 UNUSUAL DETAILS	77	75			87	90		30	55
47 CONTROLLED ASSOCIATION	64	62			51	52		60	
6 Inferences II	47	38			33			36	
7 Sentence Evaluation					-32				
8 Facts and Opinions								38	
9 Critical Evaluation								38	
11 Logical Classification								36	
13 Word Classification	39							43	
16 Word Selection	33							36	
18 Reading Comprehension	37					31			
20 Object Synthesis									35
25 Social Situations									30
26 Sound Grouping	39							31	
28 Symbolic Judgment								45	
32 Word Checking I									31
37 Vocabulary	45	32						44	
43 Arithmetic Reasoning								30	
46 Common Situations Test					32				

Key to Guilford Factors: N Attention to Detail; H Logical Evaluation; E Eduction of Correlates; F Facility with Verbal Relations; M Experiential Evaluation

Table 5 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	
COMPARABLE COMMON FACTOR 9								
8 FACTS AND OPINIONS	69	60			80	72		
9 CRITICAL EVALUATION	50	42			35	34		
10 TITLES	59	36			47	62		
11 LOGICAL CLASSIFICATION	59	63			42	38		
28 SYMBOLIC JUDGMENT	53	46		76	91	86		
37 VOCABULARY	51	56		33		32		
4 Logical Reasoning		34						
5 Inference Test		32						
7 Sentence Evaluation	39	35				31		
13 Word Classification	34	32						
16 Word Selection	33	48			33			
17 Evaluation of Comparisons		32						
40 Punched Holes						38		
43 Arithmetic Reasoning						38		
46 Common Situations Test					41			
COMPARABLE COMMON FACTOR 10								
21 OBJECT SYNTHESIS II	79	53			82	56		
24 PRACTICAL ESTIMATION	56	40			49	38		
47 Controlled Association						31		
COMPARABLE SPECIFIC FACTOR 11								J
23 PRACTICAL JUDGMENT	70	47			70	53		
11 Logical Classification	33				34			39
15 Generalizations	-31				-44	-38		
20 Object Synthesis		47						30
22 Gestalt Transformation								36
24 Practical Estimation								31
42 Ship Destination	39				38	36		
47 Controlled Association						-34		
NONCOMPARABLE FACTOR 12								G
18 Reading Comprehension		-32				-47		
20 Object Synthesis		31						43
24 Practical Estimation								33
46 Common Situations Test	79	65				67		55
NONCOMPARABLE FACTOR 13								
2 Syllogisms II		31			31	33		
10 Titles		41			38			
12 Verbal Classification	31							
20 Object Synthesis	68				62	53		
38 Spatial Orientation (Part I)	56				64	42		
43 Arithmetic Reasoning						-32		

Key to Guilford Factors: J Redefinition G Ideational Fluency

Table 5 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	A
NONCOMPARABLE FACTOR 14								
7 Sentence Evaluation					32			
9 Critical Evaluation					36			
10 Titles					50			
13 Word Classification					49			
18 Reading Comprehension					67			56
19 Absurdities					56			35
27 Figure Classification					50			
32 Word Checking I					43			42
37 Vocabulary					64			50
46 Common Situations Test					-73			
NONCOMPARABLE FACTOR 15								
36 Ratio Estimation Test				34				
40 Punched Holes				62				
NONCOMPARABLE FACTOR 16								
14 Interpretations					75			
46 Common Situations Test					-36			
NONCOMPARABLE FACTOR 17								
42 Ship Destination				81				
43 Arithmetic Reasoning				31				
NONCOMPARABLE FACTOR 18								
13 Word Classification				70				
37 Vocabulary				38				
NONCOMPARABLE FACTOR 19								
3 Syllogisms III				42				
45 Figure Analogies Completion				81				
NONCOMPARABLE FACTOR 20								
1 Syllogisms I				31				
5 Inference Test				76				
NONCOMPARABLE FACTOR 21								
1 Syllogisms I				33				
47 Controlled Association				65				

Key to Guilford Factor:

A Verbal Comprehension

Table 6
Factor Results for Matrix 12*

	Reanalyses							Guilford		
	Orthogonal				Oblique					
	I	II	III	IV	I	II	III	B		
COMPARABLE COMMON FACTOR 1										
39 ARITHMETIC REASONING	42	39	39	41	40	35	42	43		
47 SIGN CHANGES	71	52	48	55	70	52	45	51		
50 MECHANICAL PRINCIPLES	-35	-33	-36		-36	-32				
52 NUMERICAL OPERATIONS	78	75	68	68	80	76	65	66		
35 Code Analysis			39				31			
COMPARABLE COMMON FACTOR 2										
21 PICTURE ARRANGEMENT	68	56	46	57	71	59	39			
50 MECHANICAL PRINCIPLES	-59	-54	-41	-35	-60	-53	-62			
27 Verification	-32				-32		-35			
COMPARABLE COMMON FACTOR 3								K	C	J
9 COMPETITIVE PLANNING	39	40	38	41	36	32				40
12 ROUTE PLANNING	53	55	60	52	41	35	57	34	34	38
17 MATCH PROBLEMS II	69	64	62	64	72	65	63	43		32
33 PLANNING AIR MANEUVERS	60	47	43	47	63	54	35	47		
46 MATCH PROBLEMS	72	67	61	66	77	75	61	57		
10 Symbol Grouping										36
21 Picture Arrangement			31							
32 Planning Skills					-42	-39				
34 Planning a Circuit		39	46	37			52	35		39
35 Code Analysis	34	37		33						33
39 Arithmetic Reasoning	37	32			35	37				
40 Logical Reasoning	33				36	36				
50 Mechanical Principles	31	34						32	44	

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factors:

B Numerical Facility
K Adaptive Flexibility
C Visualization
J Perceptual Foresight

Table 6 (Continued)

	Reanalyses							Guilford			
	Orthogonal				Oblique						
	I	II	III	IV	I	II	III	G	M	N	F
COMPARABLE COMMON FACTOR 4											
4 PERTINENT QUESTIONS	74	71	73	73	73	67	79			58	
7 EFFECTS	79	77	76	76	80	74	77		47	46	
8 CONSEQUENCES (REMOTENESS–PART I, II)	51	48	46	46	51	49	32			30	
11 CONTINGENCIES	54	53	54	53	41	43	45	43		39	
13 PLANNING SKILLS II	68	63	62	63	84	89	72		40		
14 PLANNING ELABORATION	70	66	63	64	80	79	65	30	44		
15 FIGURE PRODUCTION	47	45	44	44	41		32		37		
16 ALTERNATE METHODS	67	62	63	64	67	53	64			44	
26 UNUSUAL METHODS	60	58	58	58	49	40	47		34		
27 VERIFICATIONS	48	46	45	45	42	48	36	38			
28 PROCEDURE APPLICATIONS	47	45	45	44	38	36	33				
32 PLANNING SKILLS	45	44	45	45	32		33				
43 PLOT TITLES (LOW QUALITY–PART I, II)	50	44	45	42	59	38	53				37
44 CONSEQUENCES (LOW QUALITY-PART I, II)	47	44	42	41	48		46				49
45 CONTROLLED ASSOCIATIONS II	40	39	39	39	36		36				
18 Symbol Production	31	34	36	35							
24 Outlining (Part II)						36					
29 Essential Operations						46		31			
31 Seeing Deficiencies	31	31	33	32				46			
38 Ship Destination						44					
40 Logical Reasoning						39					
42 Plot Titles (Clever-Part I, II)	36	35	33	34							
48 Verbal Analogies I						35					
49 Practical Judgment								30			
COMPARABLE COMMON FACTOR 5								H			
3 SENSITIVITY TO ORDER	72	53		53	72	61		46			
48 VERBAL ANALOGIES I	43	35		34	35	36		47			
5 Awareness of Variables	-35				-51						
25 Word Matrices	39			31	32						
COMPARABLE COMMON FACTOR 6								A	L		
22 SENTENCE ORDER	54	48	36	41	43				45		
31 SEEING DEFICIENCIES	55	55	34	35	59	46			36		
36 G-Z VERBAL COMPREHENSION	79	77	76	80	76	47	84	71			
37 VOCABULARY	81	78	77	83	81	55	90	73			
41 INFERENCE	57	51	39	47	53	33	32	32	30		
45 CONTROLLED ASSOCIATIONS II	41	36	38	38	32		40	30			
49 PRACTICAL JUDGMENT	51	42	34		73	56	32				

Key to Guilford Factors:

G Judgment
M Elaboration
N Conceptual Foresight
F Ideational Fluency
H Eduction of Conceptual Relations
A Verbal Comprehension
L Ordering

Table 6 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	A	L
COMPARABLE COMMON FACTOR 6 (Continued)									
1 Matrix Order	44	39			38				33
2 Seeing Trends	33								
5 Awareness of Variables	31								
6 Series					-32				
11 Contingencies	38	33		34	37				
20 Temporal Ordering	42	38		31					36
21 Picture Arrangement									53
25 Word Matrices	36	38							44
28 Procedure Applications	41	38			32				32
29 Essential Operations	42	46			34				
39 Arithmetic Reasoning	33	36							
40 Logical Reasoning	32	38							
48 Verbal Analogies I	39	43	31	39					
COMPARABLE COMMON FACTOR 7									
6 SERIES	59	35		35	33	31			
19 LINE DRAWING	62	44		34	73	56			
2 Seeing Trends	39								
18 Symbol Production	38	32		48					
23 Outlining (Part I)					-44				
38 Ship Destination	35								
COMPARABLE SPECIFIC FACTOR 8								D	E
38 SHIP DESTINATION	54	44	46		75	42	68	44	
1 Matrix Order			31				41		
3 Sensitivity to Order			35				35		
5 Awareness of Variables			33				41		
6 Series							32		
18 Symbol Production	-34								
21 Picture Arrangement							59		
22 Sentence Order							44		
23 Outlining (Part I)							43	31	
25 Word Matrices			45				66		
27 Verification			33						
29 Essential Operations	48		52		43		56	31	31
30 Ranking of Variables							38		
31 Seeing Deficiencies			36				47		
35 Code Analysis	41		37		38		56	35	
36 G-Z Verbal Comprehension			35						
39 Arithmetic Reasoning			43					31	
40 Logical Reasoning	45		56		35		60		46
41 Inference									30
44 Consequences (Low Quality-Part I, II)	-36	-34			-61	-71			
48 Verbal Analogies I	31		54				56		
50 Mechanical Principles			34						

Key to Guilford Factors: D General Reasoning E Logical Evaluation

Table 6 (Continued)

	Reanalyses							
	Orthogonal				Oblique			Guilford
	I	II	III	IV	I	II	III	I
COMPARABLE SPECIFIC FACTOR 9								
18 SYMBOL PRODUCTION	35	33	47		80	70	64	42
1 Matrix Order	42				47	45		
2 Seeing Trends			36		45	33	43	35
6 Series			31		40		39	
8 Consequences (Remoteness)								34
15 Figure Production								30
19 Line Drawing							34	
20 Temporal Ordering					32			
23 Outlining (Part I)	73	47			66	64		
26 Unusual Methods					35	34	31	32
42 Plot Titles (Clever-Part I, II)							37	36
47 Sign Changes					31		32	
NONCOMPARABLE FACTOR 10								
5 Awareness of Variables	33							
30 Ranking of Variables	77				80			
44 Consequences (Low Quality-Part I, II)	42				45			
NONCOMPARABLE FACTOR 11								
12 Route Planning	43				43	36		
34 Planning a Circuit	69				70	54		
NONCOMPARABLE FACTOR 12								
10 Symbol Grouping	71	41			73	44		
42 Plot Titles (Clever-Part I, II)	-51	-33			-52	-39		
NONCOMPARABLE FACTOR 13								
24 Outlining (Part II)					-33			
36 G-Z Verbal Comprehension						34		
51 Symbol Manipulation					79	63		

Key to Guilford Factor:

I Originality

Table 7
Factor Results for Matrix 14*

	Reanalyses							Guilford		
	Orthogonal				Oblique					
	I	II	III	IV	I	II	III	A		
COMPARABLE COMMON FACTOR 1										
8 NECESSARY FACTS	38	35	37	31	32					
16 VERBAL COMPREHENSION	80	71	73	76	86	79	76	70		
20 APTITUDE-VERBAL	86	85	84	83	89	90	84	80		
22 MECHANICS OF EXPRESSION	73	67	65	65	75	74	56	64		
23 READING COMPREHENSION	72	66	65	59	72	66	60	51		
6 Logical Reasoning	36	34	33							
9 Numerical Operations							-38			
COMPARABLE COMMON FACTOR 2								C	F	G
1 BALANCES	52	34	44	33	41	32	55			32
3 CIRCLE SQUARE TRIANGLE	45	35	47	37	31		53	33		
8 NECESSARY FACTS	46	39	35		47	41	37		32	
12 SECRET WRITING	39	33	58	42	33		60			
13 SHIP DESTINATION	72	64	64	57	74	77	73		56	36
15 SYMBOL MANIPULATION	39	34	41	36	41	37	32	37		
19 APTITUDE-SPATIAL	72	58	53	62	92	84	65	49		
4 Essential Operations	34		33							
5 Form Reasoning II			53	34			53			51
6 Logical Reasoning			39							
7 Necessary Arithmetic Operations									49	
9 Numerical Operations					-42					
11 Rules			43				38			
14 Sign Changes II										44
17 Aptitude-Quantitative, Part I	35	34			39	37			37	
COMPARABLE COMMON FACTOR 3								D	I	
10 PROBLEM SOLVING	73	66	55	54	75	72	70	46	44	
15 SYMBOL MANIPULATION II	47	34	34		33		34	36		
21 MATHEMATICS ACHIEVEMENT	65	42	34		60	39	39		48	
1 Balances					-44					
4 Essential Operations	35		31	41			31	39		
5 Form Reasoning II			31				32			
6 Logical Reasoning	37		37	43			38	50		
9 Numerical Operations							32			
14 Sign Changes II							32			
17 Aptitude-Quantitative, Part I	41	33							31	
23 Reading Comprehension				32				45		

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factors:

A Verbal Comprehension
C Visualization
F General Reasoning
G Handling Complicated Procedures
D Logical Evaluation
I Mathematical Achievement

Table 7 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	I	III	IV	I	II	III	B
COMPARABLE COMMON FACTOR 4								
7 NECESSARY ARITHMETIC OPERATIONS	72	58	39	60	77	63	65	42
9 NUMERICAL OPERATIONS	68	47	32		73	54	34	50
22 MECHANICS OF EXPRESSION	33	31	33		36	35	41	
2 Circle Reasoning			39				38	
8 Necessary Facts			34				31	
17 Aptitude-Quantitative, Part I			54	33			50	
18 Aptitude-Quantitative, Part II			40				37	
21 Mathematics Achievement			32				31	
COMPARABLE COMMON FACTOR 5								E
2 CIRCLE REASONING	73	51		49	76	55		47
17 APTITUDE-QUANTITATIVE, PART I	48	42		42	36	32		44
18 APTITUDE-QUANTITATIVE, PART II	75	61		60	78	68		56
8 Necessary Facts	36	31						31
11 Rules	43	35			39			
COMPARABLE COMMON FACTOR 6								H
5 FORM REASONING II	74	69		51	80	81		42
11 RULES	44	39		32	40	32		60
14 SIGN CHANGES II	65	43		49	72	48		
1 Balances	34	32			33			
3 Circle Square Triangle	33	34						
6 Logical Reasoning	38	36			35			
12 Secret Writing	49	45			46	38		54
15 Symbol Manipulation II		33						
NONCOMPARABLE FACTOR 7								
11 Rules				39				
12 Secret Writing				37				

Key to Guilford Factors:

B Numerical Facility
E Eduction of Patterns
H Trial and Error Manipulation

Table 8
Factor Results for Matrix 16A*

	Reanalyses							Guilford			
	Orthogonal				Oblique						
	I	II	III	IV	I	II	III	B	H	J	C
COMPARABLE COMMON FACTOR 1											
2 COMPLETION OF FIGURAL CHANGES	35	37	31		38		36		31		40
3 CORRELATE COMPLETION II	41	43	42	35		34	37		42		
5 FIGURE ANALOGIES	38	40	32		66	36	79				54
6 FIGURE ANALOGIES COMPLETION	51	47			84	54	59		53		33
11 LETTER SERIES	43	45	50	31		35	62	41	40		
14 NUMBER SERIES	50	49	61	49	32	54	46	36		43	
17 PRESCRIBED RELATIONS	57	52	35	37	57	56	34				
20 SHIP DESTINATION	56	43	45		44	48	36	61			
22 SIGN CHANGES II	70	61	55	48	49	75	38	37		39	
23 SYMBOL MANIPULATION II	57	47	41	57	42	50				43	
1 Circle Reasoning							66				
4 Critical Evaluation					-67	-37	-49				
8 Figure Matrix					43		67				39
9 Form Reasoning			50								
12 Letter Triangle	31	31			33		58		33		
15 Perceptual Relations Naming	32	35	36				66		31		45
19 Seeing Trends II	33	34	37						31		
21 Sign Changes			59								
24 Verbal Analogies I					31						

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factors:

B General Reasoning
H Eduction of Correlates
J Symbol Manipulation
C Eduction of Perceptual Relations

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Table 8 (Continued)

	Reanalyses							Guilford				
	Orthogonal				Oblique							
	I	II	III	IV	I	II	III	A	E	F	M	U
COMPARABLE COMMON FACTOR 2												
2 COMPLETION OF FIGURAL CHANGES	48	43	52	34	36	42	32					
6 FIGURE ANALOGIES COMPLETION	50	40	54			46	50					
10 INVENTIVE VERBAL RELATIONS	43	43	46	65	62	36		41			51	
13 MATRIX ORDER	50	38	40	31	59	46		42				
16 PICTURE CLASSIFICATION	51	41	32	32	75	61			37			
24 VERBAL ANALOGIES I	75	74	69	45	78	105	72	49	48			
25 VERBAL ANALOGIES COMPLETION	58	56	60	65	76	65		38	38		35	
27 VERBAL RELATIONS NAMING	34	34	34	66	53						54	
28 WORD CLASSIFICATION	69	60	61	39	70	78	69	42		45		
1 Circle Reasoning							-49					
3 Correlate Completion II			38	38							31	
4 Critical Evaluation					65			39				
5 Figure Analogies	47	40	44			48						
11 Letter Series				32								
15 Perceptual Relations Naming				38							30	
17 Prescribed Relations	36	33	53				50					41
18 Seeing Trends			45				44					59
19 Seeing Trends II			41	43								
22 Sign Changes II					-36							
23 Symbol Manipulation II			41				40					
26 Verbal Classification			41	47					30	32		
COMPARABLE COMMON FACTOR 3								G				
1 CIRCLE REASONING	74	55	48	56	86	77		44				
8 FIGURE MATRIX	52	35	42		39	31						
11 LETTER SERIES	49	47	47	40		36		36				
12 LETTER TRIANGLE	49	40	40	41	34	34		38				
15 PERCEPTUAL RELATIONS NAMING	56	50	53	33	38	44						
16 PICTURE CLASSIFICATION	44	41	32	34		33						
27 VERBAL RELATIONS NAMING	43	42	44		33	44						
2 Completion of Figural Changes			32									
3 Correlate Completion II	34	32	35	32								
5 Figure Analogies	50	49	48									
14 Number Series	31		31					32				
24 Verbal Analogies I					-35	-37						
25 Verbal Analogies Completion	37	39	39			32						
28 Word Classification					-40	-34						

Key to Guilford Factors:

- A Verbal Comprehension
- E Eduction of Conceptual Relations
- F Verbal Classification
- M Expressional Fluency
- U Unidentified
- G Eduction of Patterns

Table 8 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	K
COMPARABLE COMMON FACTOR 4								
4 CRITICAL EVALUATION	60	43	45		50	48	38	
9 FORM REASONING	66	50		62	83	54	51	53
14 NUMBER SERIES	41	38		38	54	32	44	32
21 SIGN CHANGES	77	75	37	60	91	84	78	65
8 Figure Matrix							-31	
10 Inventive Verbal Relations	33	33	55					
15 Perceptual Relations Naming				31				
22 Sign Changes II							37	
25 Verbal Analogies Completion			36					
27 Verbal Relations Naming			51					
NONCOMPARABLE FACTOR 5								
3 Correlate Completion II	42	35			38			
5 Figure Analogies					-36	-45		
10 Inventive Verbal Relations	56	51			31	36		
16 Picture Classification					-43			
18 Seeing Trends	70	49			85	55		
19 Seeing Trends II	39				33			
22 Sign Changes II					37			
23 Symbol Manipulation II	31				43			
25 Verbal Analogies Completion	45	41						
26 Verbal Classification	53	40			47	33		
NONCOMPARABLE FACTOR 6								
4 Critical Evaluation							47	
6 Figure Analogies Completion							-35	
10 Inventive Verbal Relations							74	
16 Picture Classification							35	
22 Sign Changes II							-31	
25 Verbal Analogies Completion							66	
26 Verbal Classification							35	
27 Verbal Relations Naming							79	
NONCOMPARABLE FACTOR 7								
2 Completion of Figural Changes				44				
5 Figure Analogies				49				
6 Figure Analogies Completion				63				
16 Picture Classification				32				
17 Prescribed Relations				38				
24 Verbal Analogies I				54				
25 Verbal Analogies Completion				31				
28 Word Classification				39				

Key to Guilford Factors:

K Symbol Substitution

Table 8 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	
NONCOMPARABLE FACTOR 8								
11 Letter Series				32				
20 Ship Destination				49				
NONCOMPARABLE FACTOR 9								
5 Figure Analogies				34				
8 Figure Matrix				49				

Table 9
Factor Results for Matrix 16B*

	Reanalyses							Guilford		
	Orthogonal				Oblique					
	I	II	III	IV	I	II	III	A	L	M
COMPARABLE COMMON FACTOR 1										
5 CRITICAL EVALUATION	62	45	42	52	48	44	59	37		
10 INVENTIVE VERBAL RELATIONS	55	54	68			32	80	53		47
12 PERCEPTUAL RELATIONS NAMING	37	37	41			31	44			34
16 SEEING TRENDS	58	44	34		82	60	44		34	
21 VERBAL COMPREHENSION	65	62	60	42		40	88	79		
22 VERBAL RELATIONS NAMING	50	49	52		37	42	54		32	33
25 WORD-GROUP NAMING	50	48	39		41	45	39	31	36	

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factors:

A Verbal Comprehension
L Naming Abstractions
M Expressional Fluency

Table 9 (Continued)

		Reanalyses							Guilford		
		Orthogonal				Oblique					
		I	II	III	IV	I	II	III	A	L	M
COMPARABLE COMMON FACTOR 1 (Continued)											
1	Associations III			40					31		
3	Controlled Associations II		31	34							
4	Correlate Completion II			31							44
8	Figure Matching					-34					
13	Picture Classification							-34			
14	Picture-Group Naming			32						38	
15	Remote Verbal Similarities								32		
18	Verbal Analogies I								39		
19	Verbal Analogies Completion	48	46	55				62	43		41
23	Vocabulary Completion	41	44	57				42	40		44
24	Word Classification								39		
26	Word Groups					-36	-40				
COMPARABLE COMMON FACTOR 2									P		
1	ASSOCIATIONS III	49	44		38	45	42		46		
2	ASSOCIATIONS IV	76	58		60	90	75		40		
3	Controlled Associations II	36	32		31				48		
7	Figure Classification	31				32					
10	Inventive Verbal Relations	39	43			31	37				
14	Picture-Group Naming	53	39			56	41				
15	Remote Verbal Similarities	40				45	33				
20	Verbal Classification	37	35								
23	Vocabulary Completion	38	39						41		
COMPARABLE COMMON FACTOR 3									C		
6	FIGURE ANALOGIES	70	68	67	65	67	68	49	58		
7	FIGURE CLASSIFICATION	49	39	32	35	50	38		30		
8	FIGURE MATCHING	37	32	36	33	33					
9	FIGURE MATRIX	76	56	53	57	81	63	41	55		
3	Controlled Associations II					-36					
4	Correlate Completion II		36	52	33						
11	Letter Grouping	32	38	53	36						
12	Perceptual Relations Naming	34	36	44	31						
17	Seeing Trends II			34							
18	Verbal Analogies I			40	31						
19	Verbal Analogies Completion		34	36	32						
26	Word Groups			34							

Key to Guilford Factors:

P Associational Fluency
C Eduction of Perceptual Relations

Table 9 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	E	F
COMPARABLE COMMON FACTOR 4									
15 REMOTE VERBAL SIMILARITIES	54	40	39		62	48	47		
18 VERBAL ANALOGIES I	60	51	51	53	73	63	52	43	
21 VERBAL COMPREHENSION	49	51	44	52	81	75			
24 WORD CLASSIFICATION	66	52	55	61	79	63	68		40
26 WORD GROUPS	42	39		35		32	47		
2 Associations IV							44		
5 Critical Evaluation					35				
8 Figure Matching	38				38				
10 Inventive Verbal Relations				36	32				
11 Letter Grouping					-31				
12 Perceptual Relations Naming							-33		
13 Picture Classification							50		
19 Verbal Analogies Completion	32		34	39	38			37	
20 Verbal Classification			35	32			38	34	40
25 Word-Group Naming			38	35	40		34		38
COMPARABLE COMMON FACTOR 5								I	D
1 ASSOCIATIONS III	47	37	49	41	46	37	47		
4 CORRELATE COMPLETION II	73	66	49	64	84	89	74	50	
11 LETTER GROUPING	67	57	50	56	80	74	89	56	
12 PERCEPTUAL RELATIONS NAMING	54	40		43	63	50	44	39	
17 SEEING TRENDS II	66	47	35	53	81	64	46	42	
23 VOCABULARY COMPLETION	55	47	52	48	54	51	47		
26 WORD GROUPS	64	59	54	54	70	79	47	38	
2 Associations IV			45						
3 Controlled Associations II	37		45	33	33				
7 Figure Classification									37
10 Inventive Verbal Relations	35			31					
13 Picture Classification			43				33		40
14 Picture-Group Naming			36				35		33
15 Remote Verbal Similarities					-36				
19 Verbal Analogies Completion	34								
20 Verbal Classification			36						
21 Verbal Comprehension							-42		
22 Verbal Relations Naming	39			37	33		32		
NONCOMPARABLE FACTOR 6									
11 Letter Grouping	31								
13 Picture Classification	78	56							
16 Seeing Trends	44								
25 Word-Group Naming	40	33							

Key to Guilford Factors:

E Eduction of Conceptual Relations
F Verbal Classification
I Eduction of Structural Relations
D Perceptual Classification

Table 9 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	
NONCOMPARABLE FACTOR 7								
10 Inventive Verbal Relations				38				
14 Picture-Group Naming				48				
22 Verbal Relations Naming				31				
NONCOMPARABLE FACTOR 8								
10 Inventive Verbal Relations				31				
23 Vocabulary Completion				39				

Table 10
Factor Results for Matrix 16C*

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	I
COMPARABLE COMMON FACTOR 1								
10 LETTER GROUPING	73	67	60	46	70	66	62	49
26 WORD GROUPS	50	31	43	55	37		38	49
4 Cartoons	-35				-52	-36	-42	
13 Picture-Group Naming	40		38					
18 Seeing Deficiencies			34					
25 Word-Group Naming			31					
COMPARABLE COMMON FACTOR 2								
9 GESTALT TRANSFORMATION	58	42			56	42	44	
18 SEEING DEFICIENCIES	55	41		49	55	41	70	
13 Picture-Group Naming	42	32			41		37	
16 Quick Response	-64	-34			-71	-39		
19 Seeing Problems						-37		
23 Verbal Comprehension							31	
24 Vocabulary Completion				34			61	

* Decimals have been omitted.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris R-S^2

Key to Guilford Factor:

I Eduction of Structural Relations

Table 10 (Continued)

	Reanalyses							Guilford				
	Orthogonal				Oblique							
	I	II	III	IV	I	II	III	A	P	R		
COMPARABLE COMMON FACTOR 3												
2 ASSOCIATIONS III	73	73	63	66	79	72		42	36	35		
3 ASSOCIATIONS IV	72	61	57	62	82	63	35		47			
7 CONTROLLED ASSOCIATIONS	51	48	57	49	53	42	74		56			
8 CONTROLLED ASSOCIATIONS II	46	39	51	45	46	38	78		61			
23 VERBAL COMPREHENSION	59	60	60	64	57	47	36	64				
24 VOCABULARY COMPLETION	67	62	57	60	72	67	37	44	33			
1 Apparatus Test						-31						
6 Consequences (Remote)	32		31		32		56					
9 Gestalt Transformation	37	36			37					48		
10 Letter Grouping	34			33								
11 Logical Classification	31	42	38	43				39		44		
12 Object Synthesis	33	34			32							
16 Quick Response							38					
17 Remote Verbal Similarities		32					-39			34		
18 Seeing Deficiencies										40		
25 Word-Group Naming	41	46	43	51				37				
26 Word Groups					-37							
COMPARABLE COMMON FACTOR 4								L	N	O	Q	T
1 APPARATUS TEST	79	74	76	79	83	69			45	51		
4 CARTOONS	53	47	42	32	52	53					47	
6 CONSEQUENCES (REMOTE)	64	62	60	52	51	53					32	41
7 CONTROLLED ASSOCIATION	59	56	56	53	44	47					30	
8 CONTROLLED ASSOCIATIONS II	65	61	61	62	53	65						
12 OBJECT SYNTHESIS	52	48	48	42	31		63	40				40
19 SEEING PROBLEMS	71	66	67	70	85	77			50	40		
20 SIMILARITIES	69	65	64	61	65	46	48			48		
21 SOCIAL INSTITUTIONS	78	73	69	68	88	87			38	50		
22 UNUSUAL USES	70	65	66	62	67	54	78			48	35	31
2 Associations III							45					
3 Associations IV					-33		35					
5 Consequences (Low Quality)	58	57	55	41								
9 Gestalt Transformation							45					
11 Logical Classification							59					
13 Picture-Group Naming					33	34		37				
14 Plot Titles (Clever)	38				66	67					43	
15 Plot Titles (Low Quality)	52	54	51	36								
17 Remote Verbal Similarities							56					
18 Seeing Deficiencies	31				31	39			39			
24 Vocabulary Completion	31	31										
25 Word-Group Naming					36	36		46				
26 Word Groups					45	31	40					

Key to Guilford Factors:

- A Verbal Comprehension
- P Associational Fluency
- R Judgment
- L Naming Abstractions
- N Sensitivity to Problems
- O Penetration
- Q Originality
- T Spontaneous Flexibility

Table 10 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	S
COMPARABLE COMMON FACTOR 5								
5 CONSEQUENCES (LOW QUALITY)	47			52	65	58	57	58
15 PLOT TITLES (LOW QUALITY)	52	31		48	68	62	55	60
23 VERBAL COMPREHENSION	-46	-33			-45	-41	-49	
6 Consequences (Remote)								34
11 Logical Classification	-32				-31		-32	
14 Plot Titles (Clever)	-55	-35			-49			
25 Word-Group Naming	-36				-34		-40	
NONCOMPARABLE FACTOR 6								
8 Controlled Associations II						-32		
11 Logical Classification	56	42			50	53		
17 Remote Verbal Similarities	72	34			77	51		
20 Similarities						32		
22 Unusual Uses						35		
25 Word-Group Naming	31							
26 Word Groups	41				38			
NONCOMPARABLE FACTOR 7								
18 Seeing Deficiencies			41					
21 Social Institutions			34					
24 Vocabulary Completion			33					
NONCOMPARABLE FACTOR 8								
4 Cartoons				52				
14 Plot Titles (Clever)				36				
NONCOMPARABLE FACTOR 9								
1 Apparatus Test							62	
2 Associations III							-47	
3 Associations IV							-54	
9 Gestalt Transformation							-35	
19 Seeing Problems							58	
21 Social Institutions							69	
NONCOMPARABLE FACTOR 10								
2 Associations III			31					
4 Cartoons			31					
9 Gestalt Transformation			44					
11 Logical Classification			34					
12 Object Synthesis			31					
17 Remote Verbal Similarities			39					

Key to Guilford Factor:

S Ideational Fluency

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Table 11
Factor Results for Matrix 22*

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	C	F
COMPARABLE COMMON FACTOR 1									
2 APPARATUS TEST (MINOR)	39	**	42	37	53	**	50		
6 BRICK USES (SHIFTS)	67		57	60	84		58	36	46
11 DIFFERENCES	38		48	36	31			34	
15 IDEATIONAL FLUENCY I	57		58	49	50		40	47	
18 MULTIPLE GROUPING	56		49	46	57		32	33	
20 OBJECT SYNTHESIS III	59		54	59	73		62	32	37
30 SIMILARITIES	75		64	60	81		64	49	44
3 Associational Fluency I									43
4 Attribute Listing I	33				34		37		
9 Common Needs							-34		
10 Contingencies	34		35				36		
13 Figure Concepts (Uncommonness)	33		42					31	
19 Object Naming (Shifts)			33						
23 Possibilities			31						
25 Seeing Problems - Part I			33						
COMPARABLE COMMON FACTOR 2								A	H
37 VERBAL COMPREHENSION	56		31	43	54		31	52	
38 VOCABULARY COMPLETION - PART I	75		46	71	80		84	59	48
39 VOCABULARY COMPLETION - PART II	80		48	79	90		86	52	46
3 Associational Fluency I	45			32	44			38	
14 Gestalt Transformation									40
17 Missing Links								34	
25 Seeing Problems - Part I							-31		
29 Ship Destination Test					-31				
31 Transitions (Coherence)	50				61			38	
40 Word Grouping			44						

* Decimals have been omitted.
** Method II did not converge.

Key to Factor Solutions of Reanalyses:

I Incomplete Principal Component
II Alpha
III Jöreskog
IV Harris $R\text{-}S^2$

Key to Guilford Factors:

C Ideational Fluency
F Associational Fluency
A Verbal Comprehension
H Eduction of Conceptual Correlates

Table 11 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	I	M
COMPARABLE COMMON FACTOR 3									
1 APPARATUS TEST (DRASTIC)	66		51		73		58	47	
7 CARTOONS - PART I	62		54	57	37		53	30	66
8 CARTOONS - PART II	65		56	51	43		57	40	31
2 Apparatus Test (Minor)					-31				
5 Attribute Listing II					-38				
9 Common Needs								37	
22 Pertinent Questions			34						
23 Possibilities	32								
28 Sequential Association					-39				
31 Transitions (Coherence)	33		32					30	
COMPARABLE COMMON FACTOR 4								E	J K
16 LOGICAL REASONING	62		66	59	52		57	42	33
28 SEQUENTIAL ASSOCIATION	45		49	41	34		49		48
33 VERBAL ANALOGIES I - PART I	67		65	64	64		67	57	
34 VERBAL ANALOGIES I - PART II	78		64	68	88		71	55	
35 VERBAL CLASSIFICATION - PART I	45		46	43	33				
36 VERBAL CLASSIFICATION - PART II	54		51	47	45				
2 Apparatus Test (Minor)					-31				
3 Associational Fluency I			34						
5 Attribute Listing II			31						30
17 Missing Links			31						
23 Possibilities					31				
29 Ship Destination Test	31		41						45
37 Verbal Comprehension	43		55	49					
38 Vocabulary Completion - Part I			39						
39 Vocabulary Completion - Part II			33						
COMPARABLE COMMON FACTOR 5								L	
13 FIGURE CONCEPTS (UNCOMMONNESS)	59			55	59		54	42	
40 WORD GROUPING	71			48	71		46	46	
18 Multiple Grouping							34		
24 Predicaments					-39				
29 Ship Destination Test	32								

Key to Guilford Factors:

- I Originality
- M Cartoons Specific
- E Eduction of Conceptual Relations
- J Deduction
- K General Reasoning
- L Convergent Production of Semantic Classes

Table 11 (Continued)

	Reanalyses							Guilford	
	Orthogonal				Oblique				
	I	II	III	IV	I	II	III	B	D
COMPARABLE COMMON FACTOR 6									
25 SEEING PROBLEMS - PART I	69		44	61	79		63		49
26 SEEING PROBLEMS - PART II	56		33	53	56		69		51
32 TRANSITIONS (LOGICAL ASPECTS)	71		34	56	83		71		53
1 Apparatus Test (Drastic)								30	
5 Attribute Listing II							37		
7 Cartoons - Part I	35								
10 Contingencies	34				32			45	
11 Differences	34				33				
15 Ideational Fluency I	31								
21 Paired Similarities	37				41				
22 Pertinent Questions	34			37			61	54	
23 Possibilities								33	
24 Predicaments	33			36			50	32	31
31 Transitions (Coherence)	37				36				
38 Vocabulary Completion - Part I			-33						
39 Vocabulary Completion - Part II			-35						
41 Group Indicator							54	37	
COMPARABLE COMMON FACTOR 7								G	
19 OBJECT NAMING (SHIFTS)	56		38		67		53	35	
27 SENTENCE PAIRS	71		55		79		52	39	
3 Associational Fluency I			32						
24 Predicaments	45				43				
29 Ship Destination Test	42				52				
35 Verbal Classification - Part I	33						44	42	
36 Verbal Classification - Part II	34				33		46	47	
41 Group Indicator							-49	-30	
NONCOMPARABLE FACTOR 8									
21 Paired Similarities					-37				
22 Pertinent Questions	41				43				
41 Group Indicator	77				79				
NONCOMPARABLE FACTOR 9									
2 Apparatus Test (Minor)	56								
3 Associational Fluency I	31								
5 Attribute Listing II	64				42				
14 Gestalt Transformation	-32				-65				
22 Pertinent Questions	35								
23 Possibilities	40				35				

Key to Guilford Factors:

B Conceptual Foresight
D Sensitivity to Problems
G Conceptual Classification

Table 11 (Continued)

	Reanalyses							Guilford
	Orthogonal				Oblique			
	I	II	III	IV	I	II	III	
NONCOMPARABLE FACTOR 10								
9 Common Needs	73				81			
19 Object Naming (Shifts)	-32				-32			
28 Sequential Association	43				39			
29 Ship Destination Test	33				33			
NONCOMPARABLE FACTOR 11								
7 Cartoons - Part I					-43			
12 Episodes	69				65			
14 Gestalt Transformation	-38							
21 Paired Similarities					-32			
NONCOMPARABLE FACTOR 12								
3 Associational Fluency I			41					
19 Object Naming (Shifts)			37					
23 Possibilities			37					
27 Sentence Pairs			43					
38 Vocabulary Completion - Part I			31					
39 Vocabulary Completion - Part II			40					
NONCOMPARABLE FACTOR 13								
11 Differences				37				
31 Transitions (Coherence)				40				
NONCOMPARABLE FACTOR 14								
2 Apparatus Test (Minor)			34					
10 Contingencies			40					
22 Pertinent Questions			48					
24 Predicaments			39					
26 Seeing Problems - Part II			40					
32 Transitions (Logical Aspects)			37					
38 Vocabulary Completion - Part I			37					
41 Group Indicator			55					

For all of the initial methods, the derived oblique solutions tend to drop variables with small coefficients from the common factors. Thus, more variables would be relevant to a comparable common factor, but with small coefficients, if only derived orthogonal solutions were used. Two good examples of this can be seen in CCF 3 of Matrix 23 (Table 3) and CCF 4 of Matrix 08 (Table 4).

The intercorrelations of the oblique factors are given, by initial method, in Table 12 for Matrix 23 and in Table 13 for Matrix 08. These are included as an illustration of the possible comparability in some cases and diversity in other cases of the correlations of the derived oblique factors from the various initial methods that are included on the same CCF.

RECOMMENDATION

For future studies we would recommend obtaining both derived orthogonal and derived

oblique solutions for each of these initial factor methods—Alpha, Harris R-S^2, and Unrestricted Maximum Likelihood Factor Analysis. A comparable common factor then would be defined as one having two or more of the same relevant variables on at least four of the six derived factors.

Table 12
Intercorrelations of Oblique Factors for Matrix 23[a]

Comparable Common Factor	1	2	3	4
2-I[b]	04			
II	05			
III	54			
3-I	28	48		
II	35	60		
III	69	70		
4-I	25	29	48	
II	37	39	56	
III	58	55	55	
5-I	23	52	61	44
II	32	66	66	53
III	57	70	59	49

Key to Tables 12 and 13:

[a]Decimals have been omitted.

[b]Key to initial solutions:

I Incomplete Principal Component
II Alpha
III UMLFA

Table 13
Intercorrelations of Oblique Factors for Matrix 08[a]

Comparable Common Factor	1	2	3	4	5	6	7	8	9
2-I[b]	31								
II	39								
III	29								
3-I	35	32							
II	45	40							
III	30	25							
4-I	34	25	43						
II	45	34	53						
III	44	41	44						
5-I	02	12	15	15					
II	05	17	22	23					
III	-06	16	09	13					
6-I	23	34	44	46	05				
II	31	44	57	59	07				
III	31	47	53	63	11				
7-I	38	25	36	33	01	28			
II	57	42	53	47	05	47			
III	46	34	44	36	-01	36			
8-I	28	38	24	39	16	28	24		
II	36	54	34	51	28	40	38		
III	38	37	22	42	-02	32	30		
9-I	-01	11	11	12	53	07	05	20	
II	-01	15	16	19	44	10	09	33	
III									
10-I	29	31	30	49	31	35	28	43	40
II	33	34	36	58	42	44	39	57	54
III	07	25	09	32	42	24	13	03	

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